



City of Norfolk

ADDENDUM NO. 1

Dated: December 21, 2012

JAMESTOWN CRESCENT CULVERT REPLACEMENT

Except as may be otherwise described, bidding requirements, materials, and workmanship for the work described herein shall conform to all requirements of the original Contract Documents. The following Addendum to the drawings and specifications are made a part of the project and takes precedence over the section of the specifications, in part, and/or drawings, as originally written.

This Addendum consists of Forty (40) pages and five (5) drawings. **BID DATE CHANGE**

<u>ITEM NO.</u>	<u>DESCRIPTION</u>
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1.	SPECIFICATIONS; Invitation to Bid; Page 1
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First Paragraph Delete: 1:30 p.m., Thursday, January 3, 2013

Replace with: 2:00 p.m., Tuesday, January 15, 2013

2.	SPECIFICATIONS; Form of Bid; Page 1.3-1
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Change: 1:30 p.m., Thursday, January 3, 2013

Replace with: 2:00 p.m., Tuesday, January 15, 2013

3.	SPECIFICATIONS; Agreement; Page 1.4-1
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Second Paragraph Delete: January 3, 2013

Replace with: January 15, 2013

4.	TECHNICAL SPECIFICATIONS; Section 01010
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Remove: Section 01010 in its entirety.

Replace with: Section 01010 (Addendum No. 1)

Summary: Added subparagraph 1.4.E

5.	TECHNICAL SPECIFICATIONS; Section 03300
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Remove: Section 03300 in its entirety.

Replace with: Section 03300 (Addendum No. 1)

Summary: All epoxy coated reinforcement references have been deleted and have been replaced with references for corrosion resistant reinforcing (CRR).

Deleted/modified sections include: 1.2-References, 1.6.1.1 – Epoxy Coated



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Reinforcement Steel, 2.5.1-Reinforcing Bars, 3.3-Placing Reinforcing and Miscellaneous materials, 3.5.3-Epoxy Coated Reinforcing and 3.5.3.1-Epoxy Coated Reinforcing Steel Placement and Coating Repair.

6. TECHNICAL SPECIFICATIONS; Section 03410

Remove: Section 03410 in its entirety.

Replace with: Section 03300 (Addendum No. 1)

Summary: All epoxy coated reinforcement references have been deleted and have been replaced with reference for corrosion resistant reinforcing (CRR). Deleted/Modified sections includes 1.2 – References, and 2.2 – Materials.

7. DRAWINGS

Remove: Sheets GI-001, CS-101, CS-401, CS-501, and CS-502

Replace with: Sheets GI-001, CS-101, CS-401, CS-501, and CS-502 of this addendum.

8. QUESTIONS AND ANSWERS

Q1: What is the maximum fill range? The plans call for a BCS 05 (2-5 feet of fill) design but the profile shows approximately 1.25' fill.

A1: The maximum fill range is from 1.15' to 3.16'. The culvert has been modified to a BCS-02 and sheets CS-501 and CS-502 have been modified and reflect the changes.

Q2: What type of reinforcement will be required? The specs call for epoxy coated rebar but VDOT 0-2 designs now require CRR reinforcement. I just want to be sure that epoxy coated rebar is acceptable for this project.

A2: The reinforcement required has been modified and now is indicated as all mild reinforcing steel for the box culvert and wingwalls shall be Corrosion Resistant Reinforcing (CRR), low carbon/chromium reinforcing steel conforming to ASTM A1035. All other structure shall use reinforcing steel in accordance with ASTM A 615, Grade 60. This note has been added to Plan Sheet No. GI-003 and Specification 03300 and 03410 have been modified to reflect the same changes with all epoxy coated reinforcement references deleted and replaced with the VDOT approved CRR references.

Q3: What is the skew angle for the ends of the boxes?

A3: Sheet CS-101 has been updated and now reflects the skew angle of the ends of the boxes.



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Q4: Given the fill range above the culvert, installation of GR-2A will be possible. Are there any alternatives?

A4: Sheet CS-101 has been modified and indicates that a BGR-01 (Texas T-6) shall be installed over the culvert with a minimum of two posts and pedestals. The remaining portion of the guardrail shall be a GR-2A.

9. Pre-Bid Sign in Sheet

Provided for information purposes.

Receipt of this addendum shall be acknowledged on page 1.3-1 of the Bid Form

Issued by: Toni Fralich
Contract Monitoring Specialist

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 PROJECT DESCRIPTION

The project includes the replacement of the existing concrete box culvert with a new concrete box culvert and miscellaneous site work. The existing box culvert will be demolished. The construction also includes temporary closure of Jamestown Crescent, relocation of utilities, earthwork, replacement of asphalt pavement, replacement of sidewalk, installation of a new bike lane, installation of a retaining wall and site restoration.

1.2 PROJECT LOCATION

The project is located on Jamestown Crescent between Bolling Avenue and Magnolia Avenue.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Contractor shall furnish the labor, materials, equipment and supplies to perform all Work specified and/or required to complete the project in accordance with the contract documents.
- B. Contractor's Duties: Unless specifically noted, the Contractor shall provide and pay for:
 - 1. Labor, materials, and equipment.
 - 2. Tools, construction equipment and fuel.
 - 3. Water and utilities required.
 - 4. Freight, sales tax, and building permit fees.

1.4 USE OF THE PREMISES

- A. All work shall be within the limits of construction shown on the plans.
- B. Contractor is responsible to correct all collateral damage to existing conditions caused by his work.
- C. The respective utility owners shall approve utility outages and shutdowns.
- D. The Contractor shall make provisions for maintaining two way vehicular traffic at all times on Bolling Avenue, immediately adjacent to the work area.
- E. All noise created by construction activity shall comply with the provisions of the Norfolk, Virginia, Code of Ordinances, Code of the City, Chapter 26 – Noise. Maximum Sound Pressure Levels shall not exceed 57 db(A) between 7:00 a.m. and 10:00 p.m., or 52 db(A) between 10:00 p.m. and 7:00 a.m.

1.5 REFERENCE SPECIFICATIONS AND STANDARDS

- A. The following reference specifications and standard detail drawings (latest editions) shall be applicable to this project unless otherwise superseded by the project and specifications:
1. Virginia Department of Transportation (VDOT) Road and Bridge Specifications
 2. VDOT Road and Bridge Standards
 3. Manual on Uniform Traffic Control Devices Virginia Work Area Protection Manual
 4. Virginia Erosion and Sediment Control Handbook (VESCH)
 5. Virginia Work Area Protection Manual
- B. The Contractor shall familiarize himself with the above standards and specifications, as well as these project specifications, and submit to the CE in written form any questions or proposed revisions for his interpretation or approval, respectively. Failure to comply with the standard drawings and specifications shall constitute shutdown of job and removal of unsatisfactory work at the Contractor's expense until all requirements are satisfied as directed by the CE.

1.6 PRODUCT SUBSTITUTIONS

Products specified are for establishing the type, design, and quality required. Products of equal type, design, and quality produced by other manufacturers will be considered provided the request for substitution and requisite product data is submitted to the CE for review and approval. If in the CE sole discretion an item of material or equipment proposed by the Contractor is functionally equal to that named and sufficiently similar so that no change in related work will be required, it may be considered by the CE as an "or equal" item.

1.7 EXAMINATION OF PLANS AND SITE

The Contractor shall examine the plans and site and familiarize himself with the scope of work before submitting a bid.

1.8 AUTHORITY OF THE CONSTRUCTION ENGINEER

The Contractor shall perform all of the work specified herein to the entire satisfaction, approval, and acceptance by the City. The CE shall decide the answers to all questions relating to measurements of quantities, to the character of the work performed, and to whether the rate of progress will ensure completion within the Contract time. In addition, the CE will decide all questions as to the meaning of the specifications, and the CE shall have the authority to stop the work if necessary to provide its proper execution.

1.9 AUTHORITY AND DUTIES OF THE INSPECTOR(S)

- A. Inspectors employed by the City of Norfolk (Inspector) are authorized to inspect all work performed and materials furnished. Such inspection shall extend to all or any part of the work and to the preparation, fabrication, or manufacture of the

materials used. The Inspector is not authorized to alter or waive the provisions of these specifications or to make changes in the plans.

- B. The Inspector is placed on the project to keep the CE informed of its progress and the manner in which it is being performed. The Inspector will endeavor to call to the attention of the Contractor any nonconformance with the plans or specifications. The Inspector is not authorized to make a final acceptance of the work or any part of it, to approve any operation or item, to issue instructions contrary to the plans and specifications, or to act as foreman for the Contractor. The Inspector will have authority to reject defective work and materials and to suspend work that is being improperly performed.
- C. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide completed construction that is in strict accordance with the plans and specifications.
- D. The Inspector will exercise such additional authority only as may from time to time be delegated by the CE, who shall also advise the Contractor in writing of such delegations of authority affecting his operations.

1.10 PERSONNEL – SUPERVISION

An experienced superintendent and necessary assistants competent to supervise the particular types of work involved shall be assigned to the project by the Contractor and shall be available at all times when work is in progress. The Contractor shall notify the CE in writing of the superintendent assigned. The superintendent shall represent the Contractor and all directions given to the superintendent shall be as binding as if given to the Contractor.

1.11 CONTRACTOR'S RESPONSIBILITY FOR WORK

- A. Until final acceptance of the work by the CE, the Contractor shall be responsible for maintenance and the correction of any damages that may occur in conjunction with this work. The Contractor shall rebuild, repair, restore, and make good all discrepancies or damages to any portion of his work as determined by the CE.
- B. In case of suspension of work due to inclement weather, the Contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the work and provide for adequate drainage, without compensation. Therefore, scheduling of work shall be most important in minimizing maintenance of completed work.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

Work under this section includes requirements for materials, mixing, forming, placing, finishing, and curing reinforced cast-in-place concrete. The Contractor shall provide all labor, materials, equipment, and incidental items necessary to provide all cast-in-place concrete indicated on the project drawings and as specified herein.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M182 (1991, R 2000) Burlap Cloth Made from Jute or Kenaf

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117 (1990; R 2002) Standard Tolerances for Concrete Construction and Materials

ACI 211.1 (1991; R 2002) Standard practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 301 (2005) Specifications for Structural Concrete for Buildings

ACI 302.1R (2004) Guide for Concrete Floor and Slab Construction

ACI 304R (2000) Guide for Measuring, Mixing, Transporting, and Placing Concrete

ACI 304.2R (1996) Placing Concrete by Pumping Methods

ACI 305R (1999) Hot Weather Concreting

ACI 306.1 (1990; R 2002) Standard Specification for Cold Weather Concreting

ACI 318M/318RM (2002) Metric Building Code Requirements for Structural Concrete and Commentary

ACI 347R (2003) Guide to Formwork for Concrete

ACI SP-66 (2004) ACI Detailing Manual

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 (2005) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 496 (2002) Steel Wire, Deformed, for Concrete Reinforcement

ASTM A1035/A1035M – Low-carbon, Chromium, reinforcing steel:

ASTM A 615/A 615M (2005a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616/A 616M (1996a) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM C 31/C 31M (2003a) Making and Curing Concrete Test Specimens in the Field

ASTM C 33 (2003) Concrete Aggregates

ASTM C 39 (1996) Compressive Strength of Cylindrical Concrete Specimens

ASTM C 78 (2008) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)

ASTM C 94/C 94M (2004a) Ready-Mixed Concrete

ASTM C 109 (1999) Test method for Compressive Strength of Hydraulic Cement Mortars

ASTM C 143/C 143M (2005) Slump of Hydraulic Cement Concrete

ASTM C 150 (2005) Portland Cement

ASTM C 171 (2003) Sheet Materials for Curing Concrete

ASTM C 172 (2004) Sampling Freshly Mixed Concrete

ASTM C 173/C 173M (2001e1) Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 192/C 192M (2005) Making and Curing Concrete Test Specimens in the Laboratory

ASTM C 227 (2003) Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)

ASTM C 231	(2004) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Air-Entraining Admixtures for Concrete
ASTM C 295	(2003) Petrographic Examination of Aggregates for Concrete
ASTM C 309	(2003) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 494/C 494M	(2005) Chemical Admixtures for Concrete
ASTM C 618	(2005) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 882	(1999) Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear
ASTM C 1017/C 1017M	(2003) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1107	(2005) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(2000) Structural Welding Code - Reinforcing Steel
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VIRGINIA DEPARTMENT OF TRANSPORTATION

VDOT	(2007) Road and Bridge Specifications
VDOT	IIM-S&B-81.5

1.3 DEFINITIONS

- A. "Cementitious material" as used herein shall include all Portland cement and fly ash.
- B. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the structure. A public location is accessible to persons not responsible for operation or maintenance of the structure.

1.4 SUBMITTALS

Submit the following in accordance with the General Conditions of the Contract.

1.4.1 Shop Drawings

A. Reinforcing steel

Reinforcing steel shall conform to ACI SP-66. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.4.2 Product Data

A. Materials for curing concrete

Submit proposed materials and methods for curing concrete elements.

B. Materials for placing and curing grout

Submit proposed materials and methods for placement and curing of grout beds for mooring hardware, crane and roadrail rails and other miscellaneous grout installations.

C. Epoxy bonding compound

D. Pumping concrete

Submit proposed materials and methods for pumping concrete. Submittal shall include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete will be pumped.

E. Non-Shrink Grout

1.4.3 Design Data

A. Concrete mix design

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete.

Submit a complete list of materials including type; brand; source and amount of cement, fly ash, and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. No material shall be provided unless proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Engineer.

The submittal shall clearly indicate where each mix design will be used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregate changes. In addition, copies of the fly ash test results shall be submitted.

Submit copies of laboratory test reports by independent test labs conforming to ASTM C 1077, showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. Obtain acknowledgement of receipt prior to concrete placement.

1.4.4 Test Reports

A. Concrete mix design

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix will be suitable for the job conditions. The laboratory test reports shall include mill test and all other test for cement, aggregates, and admixtures. Provide maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained versus sieve size. Test reports shall be submitted along with the concrete mix design. Obtain approval before concrete placement.

B. Compressive strength tests

C. Fly Ash

Submit test results in accordance with ASTM C 618 for fly ash. Submit test results performed within 6 months of submittal date.

D. Aggregates

ASTM C 227 for potential alkali-silica reactions, ASTM C 295 for petrographic analysis.

1.4.5 Certificates

A. Cement: Submit Certificate of Conformance in accordance with ASTM C 150 Portland cement and/or ASTM C 595 and ASTM C 1157 for blended cement.

B. Aggregates: Submit Certificate of Conformance for aggregate quality in accordance with ASTM C 33, and the combined gradation curve for grading proposed for use in the work and used in the mixture qualification, and ASTM C 295 for results of petrographic examination. Where there is potential for alkali-silica reaction, provide results of tests conducted in accordance with ASTM C 227 or ASTM C 1260. Submit results of all tests during progress of the work in tabular and graphical form as noted above, describing the cumulative combined aggregate grading and the percent of the combined aggregate retained on each sieve.

C. Admixtures: Submit Certificate of Conformance in accordance with ASTM C 494 and ASTM C 1017 for concrete admixtures, ASTM C 260 for air-entraining agent, and manufacturer's literature and test reports for corrosion inhibitor and anti-washout admixture. Submitted data shall be based upon tests performed within 6 months of submittal.

D. Fly ash: Submit Certificate of Conformance in accordance with ASTM C 618. Submit test results performed within 6 months of submittal date.

1.5 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Owner," and the "Architect/Owner" to mean the Designer.

1.6 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 for job site storage of materials. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

1.6.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

PART 2 - PRODUCTS

2.1 MATERIALS FOR FORMS

Provide wood, plywood, or steel. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS-1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining. Steel form surfaces shall not contain irregularities, dents, or sags.

2.2 FORM TIES AND ACCESSORIES

The use of wire alone is prohibited. Form ties and accessories shall not reduce the effective cover of the reinforcement.

2.3 CONCRETE

2.3.1 Contractor-Furnished Mix Design

Mix Design shall be in accordance with VDOT Class A4 concrete, ACI 211.1, ACI 301, ACI 318M/318RM, and ACI 304.2R except as otherwise specified. The compressive strength (f'c) of the concrete for each portion of the structure(s) shall be as indicated and as specified below or as indicated in the plans.

	f'c	Aggregate	Slump ASTM C 143	Water-Cement	Air Entr.
Location	Min. 28- Day Comp. Strength (psi)	ASTM C 33 Maximum Nominal (Size No.)	Maximum Range (inches)	Maximum Ratio (by weight)	(percent)
All Concrete	4000	57	4	0.40	5

In addition to the above referenced requirements, all concrete slabs-on-grade shall have a minimum flexural strength of 750 psi at 28 days in accordance with ASTM C 78.

The concrete mixture shall be proportioned to have, at the point of deposit, a maximum slump of 4 inches as determined by ASTM C 143. Where an ASTM C 494, Type F or G admixture is used, the slump after the addition of the admixture shall be no less than 6 inches nor greater than 8 inches. Slump tolerances shall comply with the requirements of ACI 117.

Provide air entrainment using air-entraining admixture. Air entrainment shall be within plus or minus 1.5 percent of the value specified and shall conform to the air limits specified in ACI 301.

The water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days shall not exceed 0.15

Fly ash shall not be used for more than 25 percent by mass of the cementitious material.

The minimum amount of Portland cement is 75 percent of the total mass of cementitious material.

The requirements for durability consideration specified in table below shall be incorporated in the mixture proportions.

Concrete Quality Requirements:

	Water-Cement	Cementitious Material	Portland Cement
Location	Maximum ratio (by weight)	Minimum quantity lb/yd ³	Minimum quantity lb/yd ³
All Concrete	0.40	675	505

2.3.1.1 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on

methodology described in ACI 211.1. The trial mixture shall use at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratio required will be based on equivalent water-cement ratio calculations as determined by the conversion from the weight ratio of water to cement by weight equivalency method.

Laboratory trial mixture shall be designed for maximum permitted slump and air content. Each combination of material proposed for use shall have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39 for 7 and 28 days. From these results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition a curve shall be plotted showing the relationship between 7 and 28-day strengths.

2.3.1.2 Required Average Strength of Mix Design

The selected mixture shall produce an average compressive strength exceeding the specified strength by the amount indicated in ACI 301. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation shall be calculated and the required average compressive strength shall be determined in accordance with ACI 301. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength shall be as follows:

- A. For f'_c between 3000 and 5000 psi, 1200 psi plus f'_c .

2.4 MATERIALS

2.4.1 Cement

Cement shall comply with ASTM C 150, Type II.

2.4.1.1 Fly Ash

ASTM C 618, Type F, except that the maximum allowable loss on ignition shall be 6 percent. Add with cement.

2.4.2 Water

Water shall comply with the requirements of ASTM C 94 and the chloride and sulfate limits in accordance with ASTM D 512 and ASTM D 516. Mixing water shall not contain more than 500 parts per million of chlorides as Cl and not more than 100 parts per million of sulfates as SO₄. Water shall be free from injurious amounts of oils, acids, alkalies, salts, and organic materials. Where water from reprocessed concrete is proposed for use in the work, submit results of tests to verify that the treatment has negated adverse effects of deleterious materials.

2.4.3 Aggregates

ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance, which may be deleteriously reactive with the alkalies in the cement. Refer to appendix, paragraph entitled "Test Method

C227" of ASTM C 33 for expansion limits. Provide aggregate containing no deleterious material properties as identified by ASTM C 295.

2.4.4 Nonshrink, Nonmetallic Grout

ASTM C 1107, salt and seawater resistant with a compressive strength of 8000 psi at 7 days in accordance with ASTM C 109 and a bond strength of 2000 psi per ASTM C 882.

2.4.5 Admixtures

ASTM C 494/C 494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures.

Provide chemical admixtures that comply with the requirements shown below and in accordance with manufacturer's recommendations, and appropriate for the climatic conditions and the construction needs. Do not use calcium chloride or admixtures containing chlorides from other than impurities from admixture ingredients.

Provide minimum concentrations of corrosion-inducing chemicals as shown in table below.

Limits on Corrosion-Inducing Chemicals

<u>Chemical*</u>	<u>Limits, Percent**</u>	<u>Test Method</u>
Chlorides	0.10	ASTM D 512
Fluorides	0.10	ASTM D 1179
Sulphites	0.13	ASTM D 1339
Nitrates	0.17	ASTM D 3867

*Limits refer to water-soluble chemicals

**Limits are expressed as a percentage of the mass of the total cementitious materials.

The total alkali content shall not increase the total sodium-oxide equivalent alkali content of the concrete by more than 0.5 lb/yd³.

2.4.5.1 Air-Entraining

Air Entraining Admixture: Provide air entraining admixtures conforming to ASTM C 260. Provide the admixture of such a type and dosage that the total air content in the hardened concrete can be readily maintained within the limits specified in table below.

<u>Air Content</u>		
<u>Nominal maximum size of coarse aggregate, (inches)</u>	<u>Size Number</u>	<u>Total air content, percent by volume (percent)</u>
3/4	67	4-8
1	57	3.5-6.5

1. Accelerating: ASTM C 494, Type C.
2. Retarding: ASTM C 494, Type B, D, or G.
3. Water Reducing: ASTM C 494, Type A, E, or F.
4. High Range Water Reducer (HRWR) (Super-plasticizers): ASTM C 494, Type F and ASTM C 1017.

2.4.6 Materials for Curing Concrete

2.4.6.1 Impervious Sheeting

Impervious Sheeting shall conform to ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2.4.6.2 Pervious Sheeting

Pervious Sheeting shall conform to AASHTO M182.

2.4.6.3 Liquid Membrane-Forming Compound

Liquid Membrane-Forming Compound shall conform to ASTM C 309, white-pigmented, Type 2, Class B.

2.4.7 Epoxy Bonding Compound

Epoxy Bonding Compound shall conform to ASTM C 881. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.

2.5 REINFORCEMENT

2.5.1 Reinforcing Bars

All reinforcing steel shall be deformed and shall conform to ASTM A615 Grade 60 except for reinforcing steels for the box culvert structure and wingwalls which shall conform to ASTM A1035 - CRR (corrosion resistant reinforcement) which shall conform to VDOT standards Section 223 and 406.

2.5.2 Mechanical Reinforcing Bar Connectors and Terminators

Reinforcing Bar Connectors and Terminators shall conform to ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.

2.5.3 Wire

ASTM A 82 or ASTM A 496.

2.5.4 Reinforcing Bar Supports

Provide bar ties and supports of coated or non-corrodible material.

PART 3 - EXECUTION

3.1 FORMS

Forms shall be in accordance with ACI 301. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water shall be watertight.

3.1.1 Coating

Before concrete placement, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

3.1.2 Removal of Forms and Supports

After placing concrete, forms shall remain in place for the time periods specified in ACI 347R. Prevent concrete damage during form removal.

3.1.2.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if ASTM C 39 test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached a minimum of 85 percent of the design strength.

3.1.3 Re-shoring

Re-shore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or re-shoring. After forms are removed, slabs and beams over 10 feet in span and cantilevers over 4 feet shall be re-shored for the remainder of the specified time period in accordance with paragraph entitled "Removal of Forms and Support", above. Perform re-shoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Re-shoring elements shall have the same load-carrying capabilities as original shoring and shall be spaced similar to original shoring. Firmly secure and brace re-shoring elements to provide solid bearing and support.

3.2 FORMED SURFACES

3.2.1 Tolerances

Tolerances shall be in accordance with ACI 347R and as indicated.

3.2.2 As-Cast Form

Provide form facing material producing a smooth, hard, uniform texture on the concrete. Arrange facing material in an orderly and symmetrical manner and keep seams to a practical minimum. Support forms as necessary to meet required tolerances. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects, which will impair the texture of the concrete surface shall not be used.

3.3 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

Placing shall be in accordance with VDOT 2007 Road and Bridge Specifications Section 406. Provide bars, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement shall not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

3.3.1 Reinforcement Supports

Place reinforcement and secure with galvanized or non-corrodible chairs, spacers, or metal hangers.

3.3.2 Splicing

As indicated. For splices not indicated ACI 301. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. Welded splices shall be approved prior to use and shall conform to AWS D1.4.

3.3.3 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Bolt threads shall match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.3.4 Cover

ACI 301 for minimum coverage, unless otherwise indicated.

3.3.5 Setting Miscellaneous Material

Place and secure all anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.3.6 Construction Joints

Construction joints will not be permitted.

3.4 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

Batching, measuring, mixing, and transporting concrete shall conform to ASTM C 94/C 94M, ACI 301, ACI 302.1R, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.4.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing", below.

3.4.2 Mixing

Mixing shall be in accordance with ASTM C 94/C 94M and ACI 301. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 85 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

3.4.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete, which has segregated in transporting and dispose of as directed.

3.5 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other. Do not permit cold joints to occur.

3.5.1 Depositing Concrete under Water

Methods and equipment used shall prevent the washing of the cement from the mixture, minimize the formation of laitance, prevent the flow of water through the concrete before it has hardened, and minimize disturbance to the previously placed concrete. Do not deposit concrete in running water, seawater, or in water temperatures below 35 degrees F. Tremies, if used, shall be watertight and sufficiently large to permit a free flow of concrete. Keep the discharge end continuously submerged in fresh concrete. Keep the shaft full of concrete to a level well above the water surface. Discharge and spread the concrete by raising the tremie to maintain a uniform flow. Place concrete without interruption until the top of the fresh concrete is at the required height.

3.5.2 Vibration

Vibration shall be in accordance with ACI 301. Furnish a spare vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate vibrators with vibratory element

submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 18 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 18-inch maximum vertical lifts. External vibrators shall be used on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

3.5.3 Application of Epoxy Bonding Compound

Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy resins.

3.5.4 Pumping

Pumping shall be in accordance with ACI 304R and ACI 304.2R. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy. Rapid changes in pipe sizes shall be avoided. Maximum size of course aggregate shall be limited to 33 percent of the diameter of the pipe. Maximum size of well-rounded aggregate shall be limited to 40 percent of the pipe diameter. Samples for testing shall be taken at both the point of delivery to the pump and at the discharge end.

3.5.5 Cold Weather

Proceed in accordance with ACI 306.1. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 5 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.5.6 Hot Weather

Proceed in accordance with ACI 305R. Maintain required concrete temperature using Figure 2.1.5 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.6 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI 302.1R, unless otherwise specified.

3.6.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleed-water appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleed-water is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleed-water.

3.6.1.1 Steel Troweled

Use for walking surfaces. First, provide a floated finish. The finish shall next be power troweled three times, and finally hand troweled. The first troweling after floating shall produce a smooth surface, which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks and uniform in texture and appearance. The finished surface shall produce a surface level to within 1/4 inch in 10 feet.

3.7 CURING AND PROTECTION

ACI 301 unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period.

3.7.1 Moist Curing

Remove water without erosion or damage to the structure.

3.7.1.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.2 Fog Spraying or Sprinkling

Apply water uniformly and continuously throughout the curing period. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

3.7.1.3 Pervious Sheeting

Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap the sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the

finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.

3.7.1.4 Impervious Sheeting

Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

3.7.2 Liquid Membrane-Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen, which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI 305R indicates that hot weather conditions will cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

3.7.2.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re-spray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

3.7.2.2 Protection of Treated Surfaces

Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

3.7.3 Curing Periods

ACI 301, except 21 days for concrete that will be in full-time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval by the Designer.

3.8 FIELD QUALITY CONTROL

An independent testing agency will be selected and paid for by the Owner. The Contractor shall be responsible for the scheduling and coordination of the work performed by the testing laboratory.

3.8.1 Sampling

Sampling shall be in accordance with ASTM C 172. Collect samples of fresh concrete to perform tests specified. Refer to ASTM C 31/C 31M for making test specimens.

3.8.2 Testing

3.8.2.1 Slump Tests

Slump Tests shall conform to ASTM C 143/C 143M. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.8.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.8.2.3 Compressive Strength Tests

Compressive Strength Tests shall conform to ASTM C 39. Make five test cylinders for each set of tests in accordance with ASTM C 31/C 31M. Precautions shall be taken to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Samples for strength tests of each mix design of and for concrete placed each day shall be taken not less than once a day, nor less than once for each 100 cubic yards of concrete. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result shall be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'_c , or if any strength test result falls below f'_c by more than 500 psi, take a minimum of three ASTM C 42 core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of f'_c and if no single core is less than 75 percent of f'_c . Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with non-shrink grout. Match color and finish of adjacent concrete.

3.8.2.4 Air Content

Air Content shall conform to ASTM C 173/C 173M or ASTM C 231 for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

PART 4 – COMPENSATION

4.1 BASIS OF PAYMENT

- A. Payment for work described in this Section and shown on the Contract Drawings, including all labor, materials, services and equipment necessary to complete the work to the satisfaction of the Owner, shall be compensated in accordance with Specification Section 01270 Measurement and Payments.

END OF SECTION

SECTION 03410

PRECAST STRUCTURAL CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work to be performed under this Section shall consist of furnishing labor, materials, equipment, and services necessary to in the performance of operations in connection with installation of the precast structural concrete as specified in this Section and as indicated on the Contract Drawings.

B. Related work specified elsewhere.

Section 03300 – Cast-in-Place Concrete

1.2 REFERENCE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ACI INTERNATIONAL (ACI)

ACI 304R	(2000) Measuring, Mixing, Transporting, and Placing Concrete
ACI 305.1	(2006) Hot Weather Concreting
ACI 306.1	(1990) Cold Weather Concreting
ACI 309R	(2005) Consolidation of Concrete
ACI 318	(2008) Building Code Requirements for Structural Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27/A 27M	(2008) Steel Castings, Carbon, for General Application
ASTM A1035/A1035M –	Low-carbon, Chromium, reinforcing steel:
ASTM A 47-99	(2004) Ferritic Malleable Iron Castings
ASTM A 123/A 123M	(2008) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2005) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 185	(2007) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 307	(2007b) Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	(2009) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 497	(2007) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 563	(2007a) Carbon and Alloy Steel Nuts
ASTM A 780	(2001) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C 33	(2008) Concrete Aggregates
ASTM C 94	(2009) Ready-Mixed Concrete
ASTM C 150	(2007) Portland Cement
ASTM C 260	(2006) Air-Entraining Admixtures for Concrete
ASTM C 494	(2008a) Chemical Admixtures for Concrete
ASTM C 595	(2008a) Blended Hydraulic Cements
ASTM C 618	(2008a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 989	(2009) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1107	(2008) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM F 436	(2009) Hardened Steel Washers
ASTM F 844	(2007a) Washers, Steel, Plain (Flat), Unhardened for General Use

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(2005) Structural Welding Code - Reinforcing Steel
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PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI MNL-116	(1999) Quality Control for Plants and Production of Structural Precast Prestressed Concrete Products
PCI MNL-120	(2004) Design Handbook - Precast and Prestressed Concrete

VIRGINIA DEPARTMENT OF TRANSPORTATION

VDOT (2007) Road and Bridge Specifications

VDOT IIM-S&B-81.5

1.3 PRECAST MEMBERS

- A. The work includes the provision of precast non-prestressed concrete herein referred to as precast members. Precast members shall be the product of a manufacturer specializing in the production of precast concrete members. In the ACI publications, the advisory provisions shall be considered to be mandatory, as though the word "shall" has been substituted for "should" wherever it appears; reference to the "Building Official" the "Structural Engineer" and the "Architect/Engineer" shall be interpreted to mean the CE.

1.4 SUBMITTALS

- A. The following shall be submitted in accordance with the General Conditions of the Contract.
 - 1. Drawings of precast members
 - 2. Anchorage and lifting inserts and devices
 - 3. Concrete mix design.
 - 4. Contractor-Furnished Mix Design: Submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Obtain approval before concrete placement.
 - 5. Fabrication: Submit quality control procedures established in accordance with PCI MNL-116 by the precast manufacturer.
 - 6. Calculations as described in paragraph 1.8 of this section.
- B. Closeout Submittals: Concrete batch ticket information

1.5 QUALITY CONTROL

- A. PCI Quality Certifications: PCI MNL-116. At the precast manufacturer's option, in lieu of core samples, ACI 318/318M, full-scale load tests may be performed. Perform on randomly selected members, as directed by the Engineer.
 - 1. Product Quality Control: PCI MNL-116 for PCI enrolled plants. Where panels are manufactured by specialists in plants not currently enrolled in the PCI "Quality Control Program," provide a product quality control system in accordance with PCI MNL-116 and perform concrete and aggregate quality control testing using an approved, independent commercial testing laboratory. Submit test results to the Engineer.

or

2. Product Quality Control: Plants shall be certified by the PCI Plant Certification Program for Category C2, C3, or C4 work.

1.6 DELIVERY AND STORAGE

- A. Lift and support precast members at the lifting and supporting points indicated on the shop drawings. Store precast members off the ground. Separate stacked precast members by battens across the full width of each bearing point. Protect from weather, marring, damage, and overload.

1.7 FACTORY INSPECTION

- A. At the option of the Owner, precast units may be inspected by the Owner's Representative prior to being transported to the job site. The Contractor shall give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Owner's right to enforce contractual provisions after units are transported or erected.

1.8 QUALITY ASSURANCE

- A. Drawing Information: Submit drawings indicating complete information for the fabrication, handling, and erection of the precast member. Drawings shall not be reproductions of contract drawings. Design calculations and drawings of precast members (including connections) shall be prepared and sealed by a Virginia registered professional engineer, and submitted for approval prior to fabrication. The drawings shall indicate, as a minimum, the following information:
 1. Marking of members for erection
 2. Connections for work of other trades
 3. Connections between members, and connections between members and other construction
 4. Location and size of openings
 5. Joints between members, and joints between members and other construction
 6. Reinforcing details
 7. Material properties of steel and concrete used
 8. Lifting and erection inserts
 9. Dimensions and surface finishes of each member
 10. Erection sequence and handling requirements

11. All calculations pertaining to final product dimensions and reinforcement which differ from the contract plans, lifting devices and any appurtenances that are not shown in the contract plans.
 12. All loads used in design (such as live, dead, handling, and erection)
 13. Bracing/shoring required
 14. Areas to receive toppings, topping thickness.
- B. Concrete Mix Design: Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Include a complete list of materials including type; brand; source and amount of cement, pozzolan, and admixtures; and applicable reference specifications.
- C. Certificates: Record Requirement: ASTM C 94. Submit mandatory batch ticket information for each load of ready-mixed concrete.

PART 2 – PRODUCTS

2.1 CONTRACTOR-FURNISHED MIX DESIGN

- A. ACI 318/318M. The minimum compressive strength of concrete at 28 days shall be 4,000 psi unless otherwise indicated. Add air-entraining admixtures at the mixer to produce between 4 and 6 percent air by volume. Water/cement ratio shall be 0.40 by weight.

2.2 MATERIALS

- A. All materials described herein shall comply with VDOT Road and Bridge Specifications and the specifications described below.
- B. Cement: ASTM C 150, Type II; or ASTM C 595 Type IP(MS) or IS(MS) blended cement, except as modified herein. The blended cement shall consist of a mixture of ASTM C 150 cement and one of the following materials: ASTM C 618 pozzolan or fly ash, or ASTM C 989 ground iron blast furnace slag. The pozzolan/fly ash content shall not exceed 25 percent by weight of the total cementitious material. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.
1. Fly Ash and Pozzolan: ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition shall be 6 percent for Type N and F.
 - a. Ground Iron Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 2. Water: Water shall be fresh, clean, and potable.
 3. Aggregates: ASTM C 33, Size 57, except as modified herein. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalies in the cement.

4. Grout: Nonshrink Grout: ASTM C 1107.
5. Admixtures
 - a. Air-Entraining: ASTM C 260
 - b. Accelerating: ASTM C 494, Type C or E
 - c. Water Reducing: ASTM C 494, Type A, E, or F
6. Reinforcement
 - a. Low-carbon, Chromium, reinforcing steel: Steel shall conform to the requirements of ASTM A1035/A1035M – Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement.
7. Metal Accessories: Provide ASTM A 123/A 123M or ASTM A 153/A 153M galvanized unless otherwise indicated.
 - a. Inserts: ASTM A 47, Grade 32510 or 35018, or ASTM A 27/A 27M Grade U-60-30
 - b. Structural Steel: ASTM A1035/1035M
 - c. Bolts: ASTM A 307; ASTM A 325
 - d. Nuts: ASTM A 563
 - e. Washers: ASTM F 844 washers for ASTM A 307 bolts, and ASTM F 436 washers for ASTM A 325 bolts

2.3 FABRICATION

- A. PCI MNL-116 unless specified otherwise.
 1. Forms: Brace forms to prevent deformation. Forms shall produce a smooth, dense surface. Chamfer exposed edges 0.75-inch, unless otherwise indicated. Provide threaded or snap-off type form ties.
 2. Reinforcement Placement: ACI 318/318M for placement and splicing. Reinforcement may be preassembled before placement in forms. Provide exposed connecting bars, or other approved connection methods, between precast and cast-in-place construction. Remove any excess mortar that adheres to the exposed connections.
 3. Concrete
 - a. Concrete Mixing: ASTM C 94. Mixing operations shall produce batch-to-batch uniformity of strength, consistency, and appearance.

- b. Concrete Placing: ACI 304R, ACI 305R for hot weather concreting, ACI 306.1 for cold weather concreting, and ACI 309R, unless otherwise specified.
 - c. Concrete Curing: Commence curing immediately following the initial set and completion of surface finishing. Provide curing procedures to keep the temperature of the concrete between 50 and 190 degrees F. When accelerated curing is used, apply heat at controlled rate and uniformly along the casting beds. Monitor temperatures at various points in a product line in different casts.
- 4. Surface Finish: Repairs located in a bearing area shall be approved by the Engineer prior to repairs. Precast members containing hairline cracks which are visible and are less than 0.2 inches in width, may be accepted, except that cracks larger than 0.05 inches in width for surfaces exposed to the weather shall be repaired. Precast members which contain cracks greater than 0.2 inches in width shall be approved by the Engineer, prior to being repaired. Any precast member that is structurally impaired or contains honeycombed section deep enough to expose reinforcing shall be rejected.
 - a. Unformed Surfaces: Provide a floated finish.
 - b. Formed Surfaces: PCI MNL-116 (Appendix A - Commentary), Chapter 3, for grades of surface finishes.
 - (1) Unexposed Surfaces: Provide a standard grade surface finish.
 - (2) Exposed Surfaces: Provide a standard grade surface finish. The combined area of acceptable defective areas shall not exceed 2 percent of the exposed to view surface area, and the patches shall be indistinguishable from the surrounding surfaces when dry.

PART 3 – EXECUTION

3.1 SURFACE REPAIR

- A. Prior to erection, and again after installation, precast members shall be checked for damage, such as cracking, spalling, and honeycombing. As directed by the Owner, precast members that do not meet the surface finish requirements specified in Paragraph 2.3, Item 4, "Surface Finish", shall be repaired or removed and replaced with new precast members.

3.2 ERECTION

- A. Precast members shall be erected after the concrete has attained the specified compressive strength, unless otherwise approved by the precast manufacturer. Erect in accordance with the approved shop drawings. Follow PCI MNL-116 and PCI MNL-120 (Chapter 8), for tolerances. Brace precast members, unless design calculations submitted with the shop drawings indicate bracing is not required.

Follow the manufacturer's recommendations for maximum construction loads. Place precast members level, plumb, square, and true within tolerances. Align member ends.

3.3 BEARING SURFACES

- A. Shall be flat and free of irregularities. Correct bearing surface irregularities with nonshrink grout. Place precast members at right angles to the bearing surface, unless indicated otherwise, and draw-up tight without forcing or distortion, with sides plumb.

3.4 ANCHORAGE

- A. Provide anchorage for fastening work in place. Conceal fasteners where practicable. Make threaded connections up tight and nick threads to prevent loosening.

3.5 WELDING

- A. AWS D1.4 for welding connections and reinforcing splices. Protect the concrete and other reinforcing from heat during welding. Weld continuously along the entire area of contact. Grind smooth visible welds in the finished installation. Welding of epoxy-coated reinforcing is not allowed.

3.6 OPENINGS

- A. Holes or cuts requiring reinforcing to be cut, which are not indicated on the approved shop drawing, shall only be made with the approval of the Engineer and the precast manufacturer. Drill holes less than 12 inches in diameter with a diamond tipped core drill.

3.7 GALVANIZING REPAIR

- A. Repair damage to galvanized coatings using ASTM A 780 zinc rich paint for galvanized surfaces damaged by handling, transporting, cutting, welding, bolting, or acid washing. Do not heat surfaces to which repair paint has been applied.

3.8 GROUTING

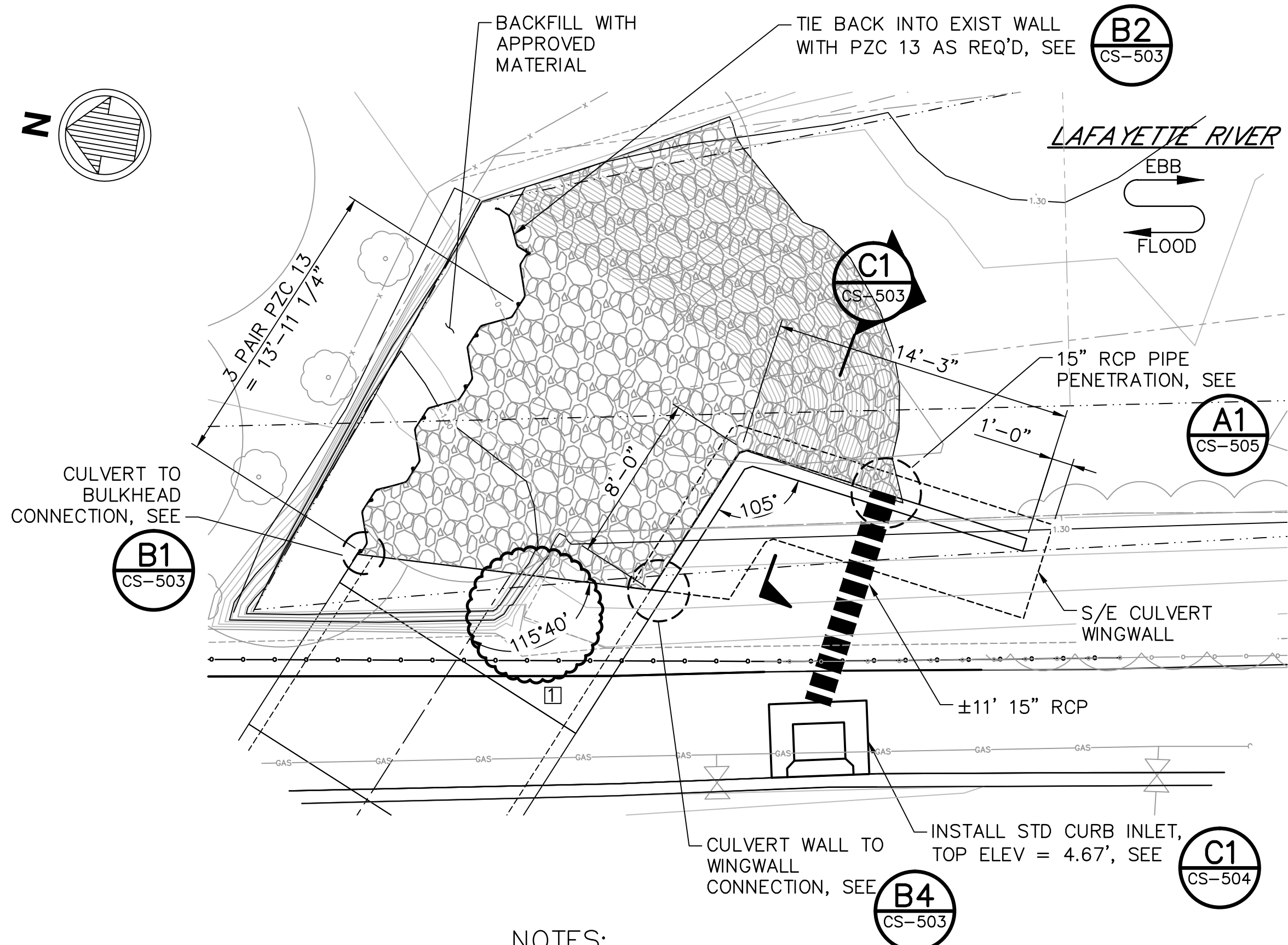
- A. Clean and fill indicated keyways between precast members, and other indicated areas, solidly with nonshrink grout or cementitious grout. Provide reinforcing where indicated. Remove excess grout before hardening.

PART 4 – COMPENSATION

4.1 BASIS OF PAYMENT

- A. Payment for work described in this Section and shown on the Contract Drawings, including all labor, materials, services and equipment necessary to complete the work to the satisfaction of the Owner, shall be compensated in accordance with Specification Section 01270 Measurement and Payments.

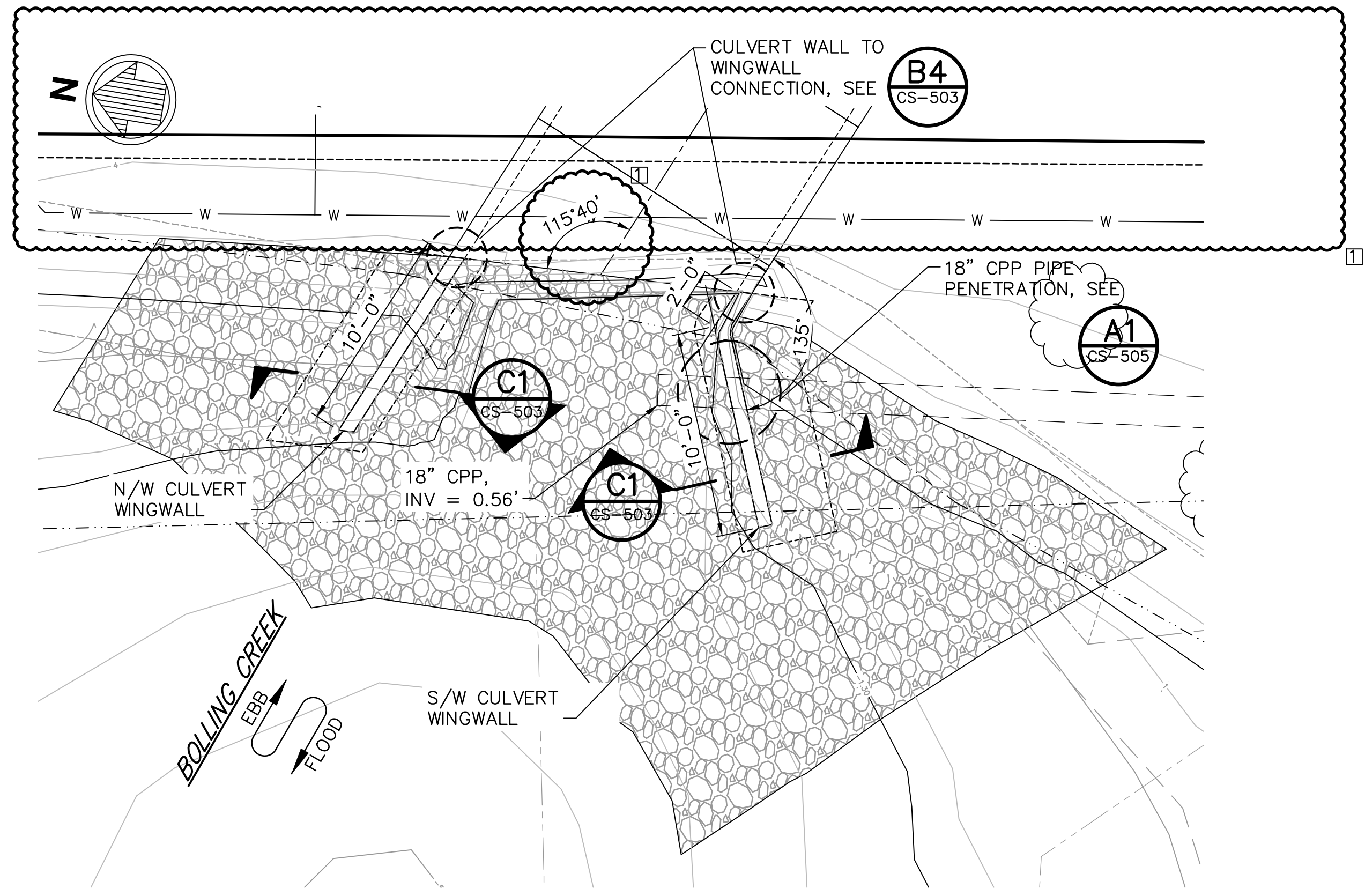
END OF SECTION



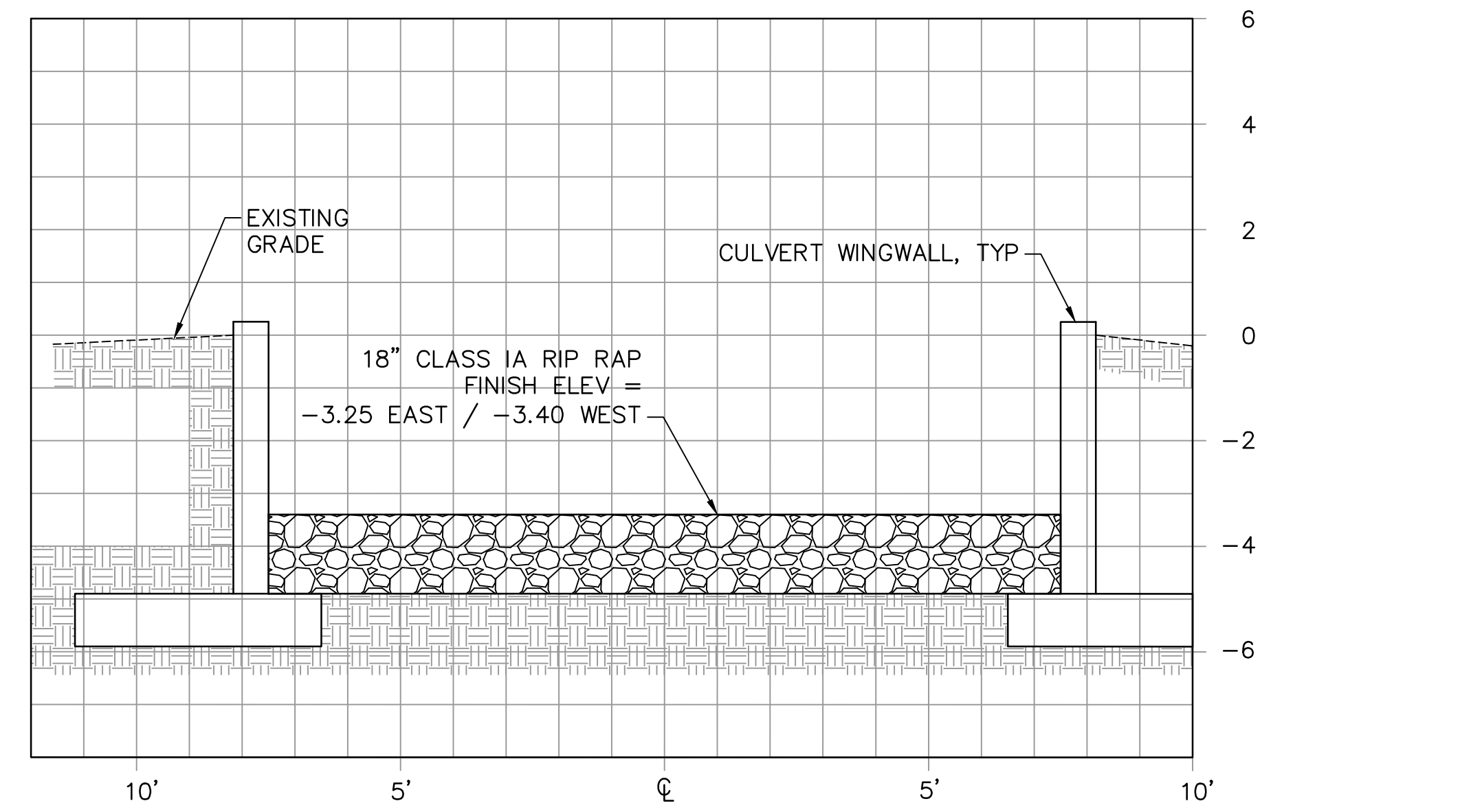
NOTES:

1. PZC 13 SHALL BE DRIVEN TO ELEV. -26.0' (NAVD88).
2. TOP ELEV. OF PZC 13 SHALL BE ELEV 4.0' (NAVD88).

C1 ENLARGED PLAN – CULVERT EAST ENTRANCE
CS-101 SCALE: 1"=5'



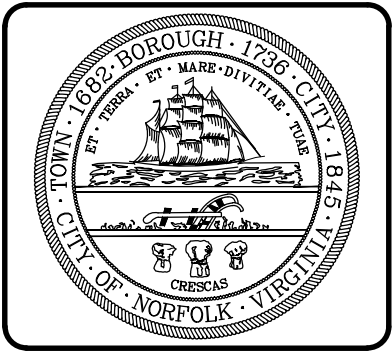
C3 ENLARGED PLAN – CULVERT WEST ENTRANCE
CS-101 SCALE: 1"=5'



A3 TYPICAL RIPRAP SECTION
CS-101 SCALE: 1"=2'-6"



DRAWING SCALES SHOWN BASED ON 22"x34" DRAWING



Mark	Description	Date	Appr.
11	NEW INCREASED AND CULVERT SEW ADDED		

**JAMESTOWN CRESCENT
CULVERT REPLACEMENT
NORFOLK, VA**

ENLARGED SITE CIVIL PLAN

800 WORLD TRADE CENTER
NORFOLK, VA 23510
757-628-8222

PREPARED FOR:
CITY OF NORFOLK DEPARTMENT
OF PUBLIC WORKS

Designed by: JEG
Dwn by: JEG
Reviewed by:

Ed by: JMH

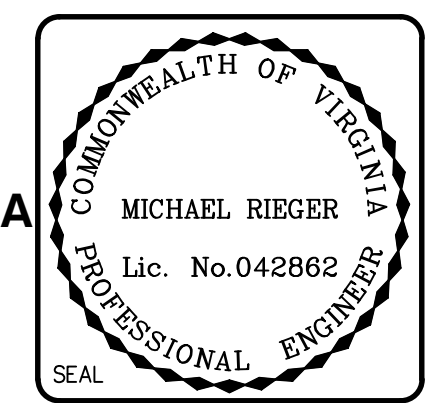
Submitted by:
MOFFATT & NICHOL

Plotter:
8/8/2012

M&N Project No.
6207-20

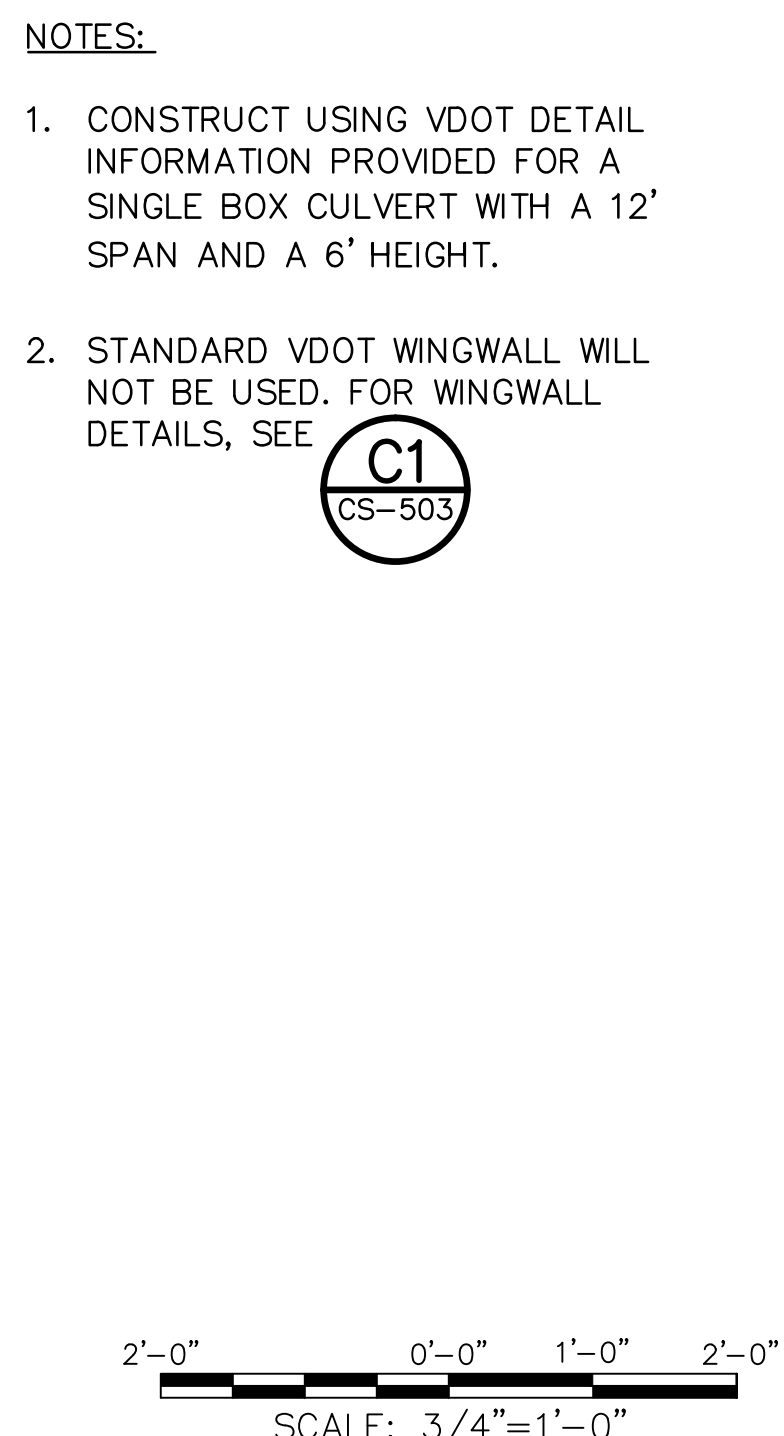
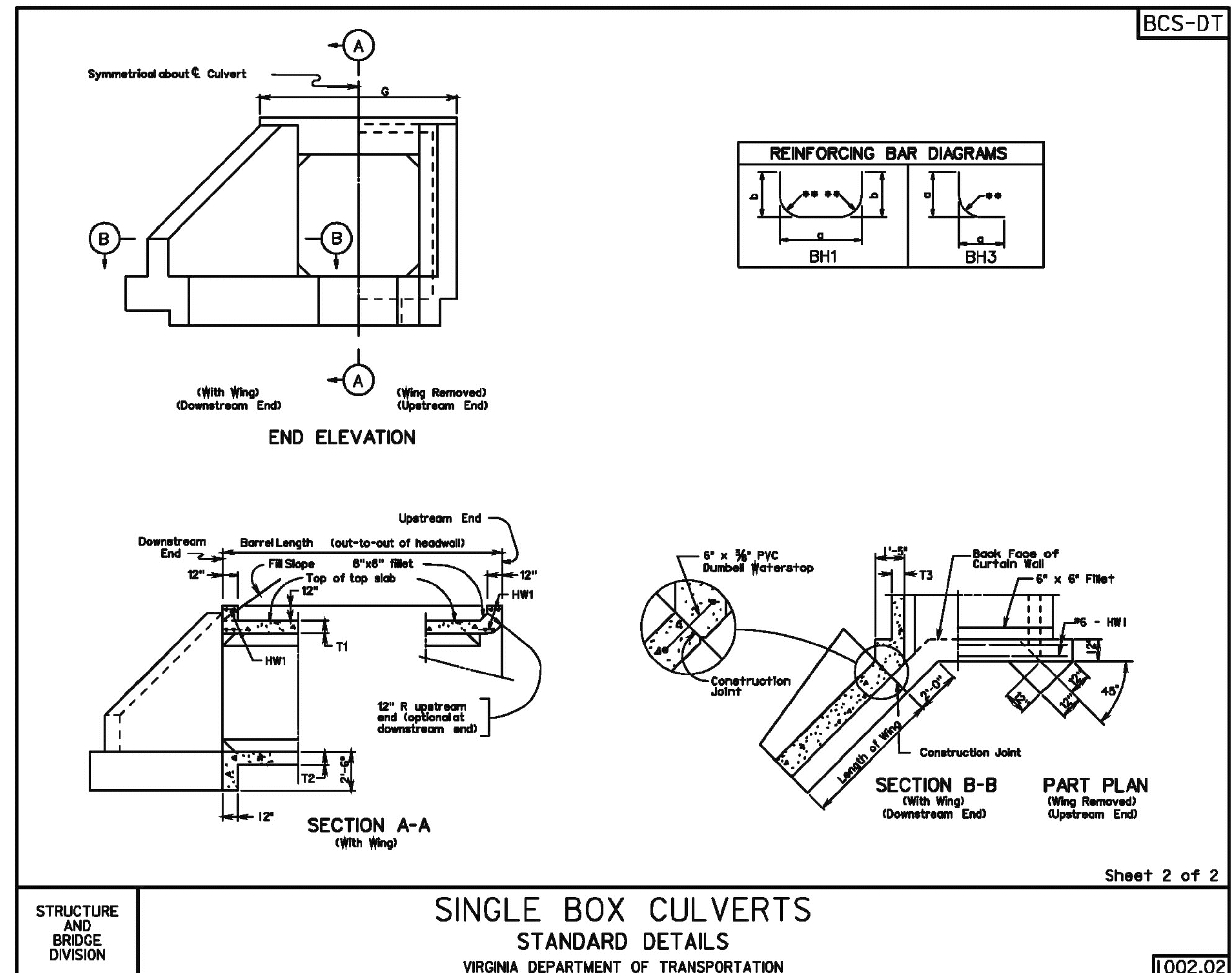
Drawing code:

Drawing Scale: 1"=5'
Plot scale: 1:1 (D SHEET)



Sheet
Reference
Number:
CS-401
Sheet 20 of 30

File: P:\6207\6207-20 Jamestown Crescent Culvert Replacement\500 CAD\520 Submittals\Submittal\620720-CS-401; Plotted: --- by OWEN, STEPHEN; Saved: 12/17/2012 5:25 PM by SOWEN



City of Norfolk
Department of Public Works
Pre - Bid Conference

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